Mortality Salience and Working Memory

A Senior Thesis

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by

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Abstract

A self threat is an event that threatens our self-esteem, self-image, public image, social acceptance, or perceived control (Leary, 2009). Research has shown that self threats, such as stereotype threat (Schmader & Johns, 2003) and social exclusion (Baumeister, Twenge, & Nuss, 2002), interfere with cognitive task performance, such as performance in intelligence tests and working memory capacity. We are investigating whether another self threat, specifically mortality salience – bringing awareness of one's eventual death– also interferes with working memory capacities and intellectual performance. Replicating previous self threat research will allow us to suggest that there may be a common mechanism underlying the psychological effects of different self threats. We predicted that thinking about one's death decreases working memory capacity and intelligence test performance and impairment in working memory capacity mediates the effect of mortality salience on decreased intelligence test performance. We tested our hypothesis with two experiments that included measures of relevant moderator variables, a manipulation of mortality salience, and measures of working memory capacity and intellectual performance. Participants first completed several questionnaires with variables that have shown to moderate effects of mortality salience. Finally, participants completed tasks measuring working memory capacities and intelligence. Results from Study 1 (N = 43) found that mortality salience decreased cognitive test performance, but did not affect working memory capacity scores. These findings suggest that the thought of one's inevitable death reduces intellectual performance. However, we could not find evidence for a mediating mechanism of working memory capacity. Study 2 (N=44), implementing a different working memory task, showed that self-esteem moderated the effects of mortality salience on intellectual performance.

Mortality Salience and Working Memory

Imagine driving on a highway and suddenly a car swerves into your lane causing an immediate reaction to slam on the brakes in order to avoid a collision. An accident is avoided, however the feelings caused by the thought of crashing and possibly losing your life may linger. Such a near death experience can bring thoughts of one's eventual and inevitable death into consciousness. Making people aware of the inevitability of death has been termed mortality salience (Becker, 1973). Threats to our very existence are powerful events and tend to make us question our sense of control and meaning. Perceived control over your own life might be overcome by the idea that there is no control over length of life or the time of death. Questions of sense and meaning might arise and the possibility that you haven't been living life meaningfully could affect your self-esteem.

Every day people encounter situations that threaten different facets of our selves. For example, people get rejected, fear that they may confirm negative stereotypes about their groups, or are sexually objectified. These situations tend to threaten self-esteem, self-image, public image, social acceptance, or perceived control (Leary, 2009). A universal threat that affects every person is the eventual and inevitable end of life. Now imagine that escape from death occurred on your way to take a college entrance exam. Such an experience might interfere with your capacity to process and store information. In turn, this is likely to affect your ability to recall mathematical calculations and solve verbal problems that are needed in order to perform well on the exam. There is evidence that threats interfere with cognitive functioning, specifically working memory and working memory related test-performance (Baumeister, et al., 2002; Schmader & Johns, 2003).

Working Memory Capacity

A plethora of different conceptualizations of working memory exist in the literature. All these conceptualizations seem to converge on the idea that working memory processes include both temporary storage of information as well as attentional capability (Engle, Tuholski, Laughlin, & Conway, 1999). People rely on working memory when reading a book, filing taxes, and planning a party (Miyake, 1999). For example, when purchasing a new car, one must take into account several different factors in order to make an informed decision. Some factors might be gas mileage, down payment, monthly payments, or the year manufactured. When comparing cars, active retrieval of information from memory about several different cars at the same time is necessary. The ability of a person to process and store information simultaneously is at the core of the concept of working memory capacity (Unsworth, Redick, Heitz, Broadway, & Engle, 2009). Working memory capacity is defined as the ability to focus attention on temporarily activated information (e.g., differences between cars), while inhibiting other information that is irrelevant to the task at hand (e.g., what roads you will take to get home). Research indicates that in completing complex intellectual tasks, working memory is more important than the availability of specific strategies and heuristics (Carpenter, Just, & Shell, 1990). There is some evidence (Schmader & Johns, 2003) that threats may be important factors that influence working memory capacity and might decrease performance on complex cognitive tests (Baumeister, et al., 2002; Schmader & Johns, 2003), specifically intelligence tests, due to an impairment of working memory.

Self-Threats and Cognitive Impairment

Two examples of threats include stereotyping and social exclusion. Both threats have been connected to cognitive impairment (Baumeister, et al., 2002; Schmader & Johns, 2003) but only

stereotype threat has been related to decreased working memory capacity (Schmader & Johns, 2003). Stereotype threat refers to the experience of being at risk of confirming a negative stereotype about one's group (Steele, 1997; Steele & Aronson, 1995). A common stereotype concerns women and math ability. This stereotype involves the belief that men are better at mathematical problems than women and earn higher scores on math tests. Research has found that women's performance was impaired when experimenters suggested that the test may be sensitive to gender (Schmader & Johns, 2003). However, group-performance differences disappear when the same test is given in a stereotype-free environment (Steele, 1997; Steele & Aronson, 1995). The main mechanism underlying this effect was decreased working memory capacity. Stereotype threats lead to lower working memory capacity scores and decreased performance on complex cognitive tasks. However, when the stereotype threat was absent, scores remained unaffected (Schmader & Johns, 2003). These results show that stereotype threat interferes with women's math test performance by reducing their working memory capacity (Schmader & Johns, 2003).

Another self threat, social exclusion, interferes with cognitive test performance (Baumeister, et al., 2002). In one study, experimenters informed participants that there was a high likelihood that they would end up alone in life, in order to instill the anticipation of future rejection. Results of three experiments showed that, in general, anticipated aloneness accounted for decreased scores in complex cognitive test performance, including an intelligence test and a verbal section of the Graduate Records Exam (Baumeister, et al., 2002). Unfortunately, these studies did not identify the mechanism underlying this effect. However, unpublished data from our lab (Crocker & Mischkowski) suggests that reduced working memory capacity is underlying the effects of social exclusion on cognitive test performance.

Given that we find similar processes underlying the effects of two different threats on intellectual performance, this suggests that self-threats in general may lower scores on complex cognitive tests via impairments in working memory. Based on this previous research, exploring the cognitive effects of another self threat is useful because it helps to build a general model about the similarities or differences on how self-threats exert their cognitive impairments. As a consequence, we want to look at the cognitive effects of another self threat that affects every living organism—the eventual end of life.

Terror Management Theory and Cognitive Performance

The idea of death can be frightening and uncomfortable and thus most people tend to push away thoughts of one's personal end of life (Becker, 1973). What happens when these thoughts are brought to one's consciousness? How do these thoughts affect everyday tasks like reading, playing a board game, or calculating the tip at a restaurant? Though mortality salience is a widely researched topic in the venue of Terror Management Theory (TMT;Burke, Martens, & Faucher, 2010) these are still questions open for further study. Terror Management Theory (Becker, 1973; J. Greenberg, Pyszczynski, & Solomon, 1986; Pyszczynski, Greenberg, & Solomon, 1999) proposes that people are motivated to maintain positive self-images and faith in their cultural worldviews to protect against deeply rooted anxiety of one's eventual death (Pyszczynski, et al., 1999). There have been over 200 experiments investigating different facets of Terror Management Theory (for review see Burke, et al., 2010). Given this abundance of research, it is somewhat surprising that there has been little to no research examining the implications of Terror Management Theory on intellectual performance. In an experiment looking at mortality salience and effort on a cognitive task (Paratore, 2007), results showed that when people were confronted with thoughts of their own death, they spent more time and put

more effort into a cognitive task. This experiment allows for insight into effort on a cognitive task, but it does not examine performance on an actual cognitive task. Another study connected Terror Management Theory with physical performance. This research showed that people whose self esteem was contingent on athleticism had increased strength performance on a physical activity when confronted with thoughts of their own death (Peters, Greenberg, Willimas, & Schneider, 2005). These two lines of research suggest that cognitive performance would increase after receiving a mortality salience manipulation. However, this hypothesis has not yet been directly tested.

Goals of the Present Research

The present research addresses two missing links in the literature. First, we tried to replicate previous findings about the cognitive effects of different self threats, with mortality salience as another self-threat. By replicating threat effects, we can infer that self threats in general may impact basic and complex cognitive abilities. This would suggest that there may be a common mechanism underlying the effects of different threats. Second, mortality salience is a widely researched topic in the context of Terror Management Theory; however in relation to working memory capacity and intellectual test performance mortality salience remains unexplored. This is our second goal, to expand the Terror Management Theory literature by investigating the effects of mortality salience on intelligence test performance. Due to the limited amount of research regarding mortality salience and intellectual performance, our predictions align with previous results found with other self threats (Baumeister, et al., 2002; Schmader & Johns, 2003). As a consequence, we predicted that mortality salience decreases higher cognitive abilities, e.g. logical reasoning or verbal comprehension – as it is often

measured in intelligence tests – and that impairment in working memory capacity account for these effects. These hypotheses were tested in two studies.

STUDY 1

The purpose of Study 1 was to investigate the effect of mortality salience on intellectual performance and working memory capacity. We aimed to replicate previous findings of self threats reducing intelligence test performance (Baumeister, et al., 2002; Schmader & Johns, 2003) and we predicted this reduction would be mediated by working memory capacity (Schmader & Johns, 2003).

Method

Participants.

Participants were 43 undergraduate students from The Ohio State University *(21 male, 22 female)* who received course credit for participation in an hour-long study. Demographics include 97.7% were Caucasian and 2.3% had another racial background. All participants were native English speakers.

Materials and Procedure.

Most materials were presented on a computer, using MediaLab (Jarvis, 1997). In addition, participants received a "Personality and Intelligence" packet, which included the materials for two tasks, specifically a word search task and a working memory task. These tasks could not be implemented in MediaLab. The packet also included a scratch piece of paper.

The experiment included the measurement of moderator variables in the beginning of the study, mortality salience vs. control as independent variables, and measures of working memory capacity and intelligence as dependent variables.

This experiment included groups of participants ranging from one to four participants. Participants were made to believe that they were participating in an experiment about personality and intelligence. Using a cover story was vital to the experiment because the Mortality Attitudes Personality Survey (Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon, 1989) has been used as a death prime in most (79.8%) Terror Management Theory studies (Burke, et al., 2010). Participants were recruited from undergraduate introductory Psychology courses to participate in the study and could have possibly learned in class about Terror Management Theory and the manipulation used to induce mortality salience. If participants were aware of what we were testing, this might have influenced the effect of the manipulation. To assure that participants were oblivious, we checked for suspicion at the end of the study and found that all participants remained unaware. At the start, the experimenter received informed consent from participants, and distributed the personality and intelligence packet. Next, the experimenter described directions for how to complete the working memory task. In this task participants timed themselves on the computer, so giving them directions in the beginning was intended to reduce the amount of error.

Moderator variables.

Participants completed a battery of questionnaires in the following order: A measure of self-esteem (Rosenberg, 1965), fear of death and dying (Collett & Lester, 1969), religious fundamentalism (Altemeyer & Hunsberger, 1992), rejection sensitivity (Downey & Feldman, 1996), right wing authoritarianism (Altemeyer & Hunsberger, 1992), and fear of negative evaluations (Watson & Friend, 1969). These measures have been shown to moderate the mortality salience manipulation (Burke, et al., 2010).

Self-esteem. Self-esteem is the second most commonly used within study moderator in Terror Management Theory research (Burke, et al., 2010). To measure self-esteem, we used a self-report measure, specifically the Rosenberg Self-Esteem scale (Rosenberg, 1965). This measure contained 10 items; participants reported on a Likert scale (1 being *extremely uncharacteristic* to 5 being *extremely characteristic*) about their dispositional self-esteem. For the complete questionnaire see Appendix 2.

Fear of death and dying. To measure fear of death and dying, we used Collett & Lester's (1969) fear of death and dying self-report measure. This measure contains 32 items where participants reported how disturbed or anxious (1 being *not* to 5 being *very*) they were about both the interpersonal and intrapersonal death and dying. For the complete questionnaire, see Appendix 1.

Religious fundamentalism. We used a religious fundamentalism questionnaire designed by Altemeyer & Hunsberger (1992) that contains 12 items in which participants reported on a Likert scale (-4 being *very strongly disagree* to 4 being *very strongly agree*) about various religious ideas. For complete questionnaire see Appendix 3.

R*ejection sensitivity.* To measure how sensitive the participants were overall to rejection we used a questionnaire developed by Downey & Feldman (1996). This questionnaire was compiled of 18 situations in which they reported 1) how concerned or anxious (1 being *very unconcerned* and 6 being *very concerned*) would they be that the other person would reject them, and 2) how likely it would be that the other person would reject them (1 being *very unlikely* to 6 being *very likely*). For the complete questionnaire, see Appendix 4.

Right wing authoritarianism. We used a right wing authoritarianism questionnaire designed by Altemeyer & Hunsberger (1992) that contains 6 items in which participants reported

how much they agreed with the statement (1 being *strongly disagree* to 7 being *strongly agree*). Authoritarianism has been shown to correlate with religious fundamentalism (Altemeyer & Hunsberger, 1992). For the complete questionnaire, see Appendix 5.

Fear of negative evaluations. To measure apprehension about other's evaluations, distress over personal negative evaluations, avoidance of evaluative situations, and the expectation that others would evaluate oneself negatively (Watson & Friend, 1969) we used a questionnaire from Leary (1983) that contains 12 items. Participants were asked to describe how characteristic each item was of them (1 being *not at all characteristic* to 5 being *extremely characteristic*). For the complete questionnaire, see Appendix 6.

Manipulation and filler task. The manipulation used was the Mortality Attitudes Personality Survey (Rosenblatt, et al., 1989). Participants were then randomly assigned to one of two conditions. People in the mortality salience group were asked to "describe the emotions that the thought of your own death arouses in you," followed by "describe what will happen to you as you physically die and as you are physically dead." They had 2.5 minutes to write a short essay for each prompt. People in the control group were given a parallel essay prompt which asked them to "describe the emotions that the thought of visiting the dentist arouses in you" followed by "describe what will happen to you as you physically visit the dentist and what will happen to you physically while visiting the dentist." This manipulation reliably induces mortality salience thoughts as shown in many (79.8%) mortality salience studies (Burke, et al., 2010). After the manipulation, participants worked on a filler task, specifically a word search task, for 1 minute. Filler tasks in between the mortality salience manipulation and the dependent variable have shown to facilitate effects of the mortality salience by allowing the thoughts of death to fade

from consciousness (Pyszczynski, et al., 1999). For the complete manipulation, see Appendices 7 and 8.

Dependent variables. Afterwards, all participants completed the Trail Making Test as a measure of working memory capacity (Corrigan & Hinkeldey, 1987). The instructions included a brief description of the Trail Making Test. Participants were instructed that they would be presented with 25 circles distributed over a sheet of paper. In Part A, the circles were numbered 1-25. Participants were instructed to draw lines connecting the numbers in ascending order. Following the written instructions, participants were shown a picture example. After the picture example they were told to click "continue" on the computer screen when they were ready to begin. Once finished with the task, they were instructed to click "continue" again as quickly as possible to record the time they needed to complete the Trail Making Task. After Part A, participants received instructions on how to complete Part B. In Part B, the circles include both numbers (1-13) and letters (A-L). Similar to Part A, they were instructed to draw lines to connect the circles in an ascending pattern, but with the added task of alternating between the numbers and letters (i.e., 1-A-2-B-3-C, etc.). Participants clicked "continue" when they wanted to begin the task and a second time, once they had finished. Part A has been shown to measure visual search (Nchez-Cubillo et al., 2009) however we were not interested specifically in this. The amount of time it takes to complete Part B has been used as a measure for their working memory capacity (Nchez-Cubillo, et al., 2009). We used Part A as a covariate in all analysis involving this measure. Afterwards, participants completed the General Mental Abilities Test (GMAT; Janda, 1996) which measures intelligence, specifically logical reasoning, spatial, and mathematical abilities. For both dependent variables, see Appendices 9 and 10.

Background measures and debriefing. Then, participants provided socio-demographic information about their gender, ethnicity, and race. To make sure we maintained deception throughout the study, participants received an open-ended suspicion question in which they were asked to write about what they thought the study was about. All participants passed this test of suspicion. Finally, participants were thanked for their effort and debriefed. The debriefing information included description of about the real purpose of the study and reasons of why deception was necessary

Results

Overview of statistical analyses

First, we used Analyses of Variance (ANOVAs) to analyze main effects mortality salience condition on intelligence test performance and working memory capacity. Second, we looked at potential moderators of the effect of mortality salience on cognitive performance using multiple regressions following recommendations by (Aiken & West, 1991). We used dummy coding for our analysis, setting mortality salience as 1 and condition as 0. We also mean centered the moderators. For post hoc analysis we recoded our dummy coding into control as 1 and mortality salience as 0. We also analyzed simple slopes with of high and low levels of moderators between conditions, and also differences between high and low levels of moderators within a condition. This was consistent for all of our analysis. To gauge the size of our effects we report partial η^2 in our ANOVAS and change in R^2 in our regressions. According to Cohen (1988, 1992) a partial η^2 of .01 constitutes a small effect, a partial η^2 of .06 constitutes a medium sized effect, and a partial η^2 of .14 constitutes a large effect. With regard to change in R^2 Cohen (1992) identifies a change in R^2 of .01 as a small effect, a change in R^2 of .09 as a medium sized effect, and a change in R^2 of .25 as a large effect.

Main effects of the mortality salience manipulation.

Using Analyses of Variance (ANOVAs) to analyze main effects of our manipulation we found support for our hypothesis that mortality salience decreases performance on an intelligence test. A significant difference ($F(1, 41) = 4.44$, $p = .04$, $\eta^2 = .10$) between mortality salience condition and control condition was found on intelligence test performance (for means, see Table 1). No significant main effects emerged between conditions on working memory performance, $F(1,43) < 1$. This finding was inconsistent with our hypothesis.

Table 1. Mean GMAT scores

	Mortality Salience	Control
M	25.9	30.1
SD	1.4	1.5

Moderator effects

To deepen our understanding of these results we analyzed potential moderators of the effect of mortality salience on cognitive task performance; to do so, we used multiple regression analyses following the recommendations by Aiken and West (1991).

Fear of Death and Dying. We found a marginal significant interaction between mortality salience condition and fear of death and dying on working memory capacity, $\beta = -.33$, $p = .06$, $\Delta R^2 = .05$. Post Hoc analyses revealed that in the control group, people high in fear of death and dying took longer (did worse) on the working memory task than people in the mortality salience condition, $\beta = -.38$, $p < .05$ (see Table 2 and Figure 2). However there was no

difference in working memory capacity scores between people in high and low fear of death and dying in the mortality salience condition, β = -.06, p = .72. In the control condition, people high in fear of death and dying scored higher on the working memory task than people low in fear of death and dying, β = .42, p < .05. Finally, there was no difference between conditions in working memory scores for people who were low in fear of death and dying, β = .42, p = .53. We found a marginal significant interaction between mortality salience condition and fear of death and dying intelligence test performance, β = -.48, p = .05, ΔR^2 = .08.

Table 2.

Hierarchical regressions of working memory capacity from mortality salience condition, fear of death and dying, and their interaction.

Term	*B*	*SE B*	β
Step 1			
Part A TMT performance	7.69	1.59	.61***
Mortality salience condition[a]	-1.95	3.45	-.08
Fear of death and dying	1.77	1.74	.14
Step 2			
Part A TMT performance	7.92	1.56	.62***
Mortality salience condition[a]	-2.64	3.38	-.11
Fear of death and dying	5.55	2.72	.44**
Fear of death and dying x mortality salience condition [b]	-6.12	3.45	-.36*

Notes. R^2 > .51 (p < .001) in Step 1, ΔR^2 = .05 in Step 2 (p < .10). All βs are non-significant (ps > .05), unless indicated otherwise. [a] Dummy coded with mortality salience = 1, dental pain = 0

***p < .001, ** p < .05, * p < .10

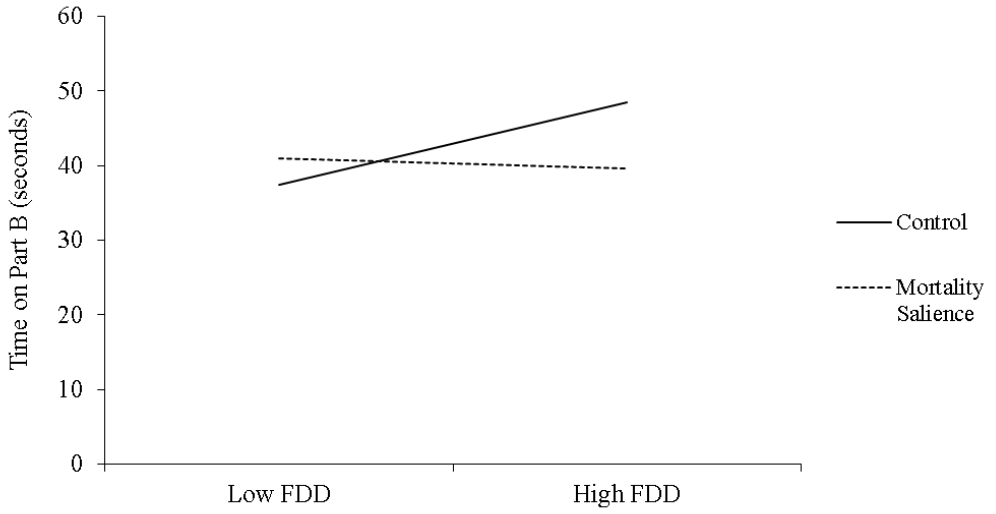

Figure 2. Working memory capacity as a function of mortality salience and fear of death and dying. Means are depicted for low (-1 SD) and high (1 SD) fear of death and dying. Scale ranges from 0 to 70, with higher numbers signifying more time spent on part B in Trail Making Test.

Table 3

Hierarchical regressions of intelligence test performance from mortality salience condition, fear of death and dying, and their interaction.

Term	*B*	*SE B*	β
Step 1			
Mortality salience condition[a]	-4.46	2.22	-.33*
Fear of death and dying	.29	1.12	.04
Step 2			
Mortality salience condition[a]	-4.99	2.16	-.37**
Fear of death and dying	3.01	1.74	.44*
Fear of death and dying x mortality salience condition [b]	-4.45	2.22	-.48*

Notes. $R^2 > .10$ ($p > .10$) in Step 1, $\Delta R^2 = .08$ in Step 2 ($p < .10$). All βs are non-significant (ps > .05), unless indicated otherwise. [a] Dummy coded with mortality salience = 1, dental pain = 0

***$p < .001$, ** $p < .05$, * $p < .10$.

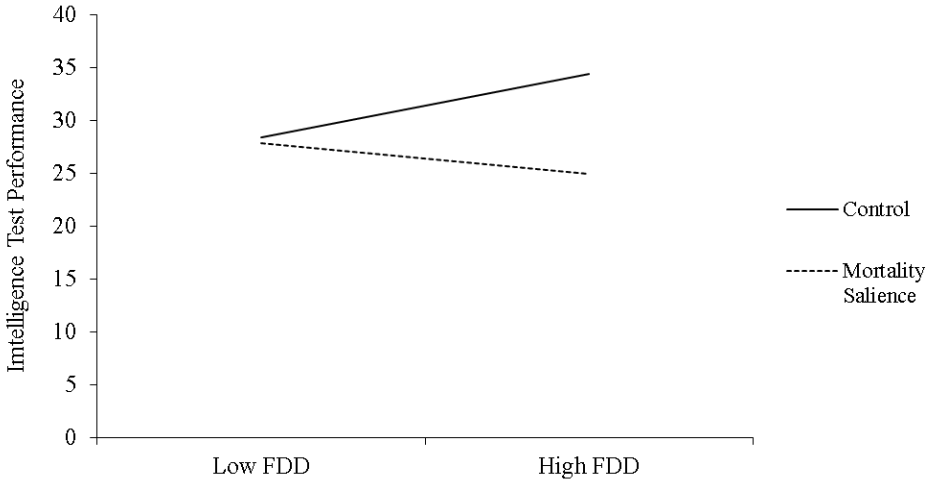

Figure 3. Intelligence test performance as a function of mortality salience and fear of death and dying. Means are depicted for low (-1 SD) and high (1 SD) fear of death and dying. Scale ranges from 0 to 40, with higher numbers signifying better performance on the GMAT.

Post Hoc analyses revealed that in the control group, people high in fear of death and dying performed better on the intelligence test than people in the mortality salience group, $\beta = .44$, $p < .10$ (see Table 3 and Figure 3). However there was no difference in intelligence test scores between people high or low in fear of death and dying in the mortality salience condition, $\beta = -.21$, $p = .31$. In the control group, people high in fear of death and dying scored higher on the intelligence test than people with low fear of death and dying, and this effect was marginally significant $\beta = -.37$, $p < .05$. There was a significant difference between conditions; people who were high in fear of death and dying in the control group performed better on the intelligence test than people who were high in fear of death and dying in the mortality salience condition $\beta = -.70$, $p < .01$. There was no difference between conditions for people who were low in fear of death and dying, $\beta = -.04$, $p = .85$.

We found no significant interactions between mortality salience condition and self-esteem, right wing authoritarianism, fear of negative evaluations, religious fundamentalism, and

rejection sensitivity in predicting working memory performance, all *p*s > .10, or intelligence test performance, all *ps* > .10.

Discussion

We found support for our hypothesis that mortality salience decreases performance on an intelligence test. People in the mortality salience group scored lower than people in the control group ON WHAT?. Using multiple regressions, we found that one moderator (fear of death and dying) qualified this effect. People who possessed high fear of death and dying, and were confronted with thoughts of their own death did significant worse than people with high fear of death and dying in the control group. In contrast to these findings, we did not find that mortality salience decreased working memory capacity performance. As a consequence, we could not test for mediation because an effect of the manipulation on the hypothesized mediator is a prerequisite for testing mediation (Baron & Kenny, 1986). Further analysis of the effect of the mortality salience manipulation on working memory capacity using multiple regressions showed that participant's trait level of fear of death and dying interacted with mortality salience condition in the control group, but not the mortality salience group. Participants who had high fear of death and dying in the control group showed lower working memory capacity scores than people with low fear of death and dying. This result might be due to people who have a high fear of death and dying possessing an anxiety buffer against mortality salience, but not against uncomfortable feelings about visiting the dentist. Also, given that the sample consisted of college students, we could assume that visiting the dentist is a much more common threat than dying. This interaction might look different with an older population because older people may have a heightened awareness of their death. Future studies could look at different age groups tease apart the differences of types of fear between death and dental pain.

Study 1 provides evidence that mortality salience impairs people's abilities to perform on an intelligence test which is consistent with research about the effects of other self-threats on intellectual performance (Baumeister, et al., 2002; Schmader & Johns, 2003). However, unlike previous research, we could not find evidence that working memory capacity, as measured with the Trail Making Test (Corrigan & Hinkeldey, 1987; Nchez-Cubillo, et al., 2009), was the psychological mechanism mediating this effect. This failure to replicate effects of other self-threats could have been due to the type of working memory task we used in Study 1. First, we deviated from the way our measure of working memory capacity is usually administered. Normally, the Trail Making Test is timed by an evaluator and mistakes are accounted for in the end score. However, to more efficiently run participants, we had participants time themselves and this might have caused errors; for example, participants may not have understood the directions and may have timed themselves incorrectly. Also, previous studies have used different measures of working memory capacity which may tap into different constructs of working memory capacity (Schmader & Johns, 2003). As a consequence, we used a different working memory task in Study 2 in which participants were only expected to perform, not to record start and stop times.

STUDY 2

The purpose of study to was to replicate results in Study 1. To implement a working memory capacity measure that does not rely on participant's ability to time themselves we used a different measure of working memory capacity than in Study 1. Again, we predicted mortality salience decreases intelligence test performance, and this decrease is due to impairments in working memory capacity.

Method

Participants. Participants were 49 undergraduate students from The Ohio State University *(11 females, M_{age}=21.4 SD* = 12.3) who received partial course credit for participation in an hour-long study. 91.3 % were Caucasian, 8.7% had another racial background and all were native English speakers. We excluded 4 participants who left halfway through the study before receiving the manipulation. We excluded participants who scored two standard deviations below the mean sample performance in the working memory capacity and intelligence measures in order to exclude participants who were not motivated, which resulted in the exclusion of 1 participant. This reduced our sample to 44 participants.

Materials and Procedure.

The procedure of Study 2 was nearly identical to Study 1 with several exceptions. First, we added another moderator measure, specifically the Mindful Attention Awareness Scale (MAAS;Brown & Ryan, 2003) to our battery of baseline measures. We included the MAAS in Study 2 because research has shown that mindfulness moderates the effects of self threats (Niemiec et al., 2010). Second, we excluded several questionnaires from Study 1 (right wing authoritarianism, fear of negative evaluations, and rejection sensitivity) due to time constraints. Finally, instead of the Trail-Making Test (Corrigan & Hinkeldey, 1987) participants completed an Operation Span Task (Schmader & Johns, 2003) as a measure of working memory capacity. In this task participants were presented with 12 sets of several sentence and word combinations (4-6 combinations; e.g., "I enjoy walking to the store"/dust). For each sentence, participants were told to count the numbers of vowels included and memorize the subsequent word. After each set of sentence and word combinations they received a prompt asking them to write down of the words they could remember from a given set. The number of perfect sets of words remembered served as measure of working memory score; for example, when participants

recalled 4 words of a set of 4 words, they received full points for this set; however, if they recalled less than 4 words in this set, they did not receive any points for this set. We administered a different working memory measure because we wanted to avoid the shortcomings of the measure used in Study 1 and also use a measure that has been shown to be sensitive to the influence of self-threat (Schmader & Johns, 2003).

Results

Main effects of the mortality salience manipulation

Again, we conducted ANOVAs with manipulation condition (mortality salience vs. control) as the dependent variable. Contrary to hypotheses, the mortality salience (M = 29.1, SD = 6.9) did not differ significantly in working memory capacity from the control condition (M = 29.4, = 6.3), $F(1, 42) > 1$, $p = .89$. Also, contrary to hypotheses, the mortality salience condition (M = 37.3, SD = 13.8) did not significantly differ from the control group (M = 35, SD = 13.4) in intelligence test performance, $F(1, 42) > 1$, $p = .59$. As in Study 1, we analyzed whether moderators qualified the effect of the manipulation on dependent variables, using Aiken & West's (1991) recommendations.

Moderators effects

Self esteem. We found a significant interaction between mortality salience condition and self esteem on intelligence test performance, $\beta = .47$, $p = .04$, $\Delta R^2 = .11$ (see Table 4 and Figure 4). Post hoc analyses revealed that in the mortality salience condition participants high in self esteem tended to score higher on the intelligence test than people low in self esteem; however this was not a significant difference, $\beta = .34$, $p = .15$.

Table 4

Hierarchical regressions of intelligence test performance from mortality salience condition, self esteem, and their interaction.

Term	*B*	*SE B*	β
Step 1			
Mortality salience condition	-.39	2.21	-.03
Self esteem	.17	1.10	.03
Step 2			
Mortality salience condition	-.095	2.12	-.01
Self esteem	-2.12	1.49	-.13
Self esteem x mortality salience condition	4.57	2.10	.04*

Notes. $R^2 > .00$ ($p > .05$) in Step 1, $\Delta R^2 = .12$ in Step 2 ($p < .05$). All βs are non-significant ($ps > .05$), unless indicated otherwise.

* $p < .05$

[a] Dummy coded with mortality salience = 1, dental pain = 0

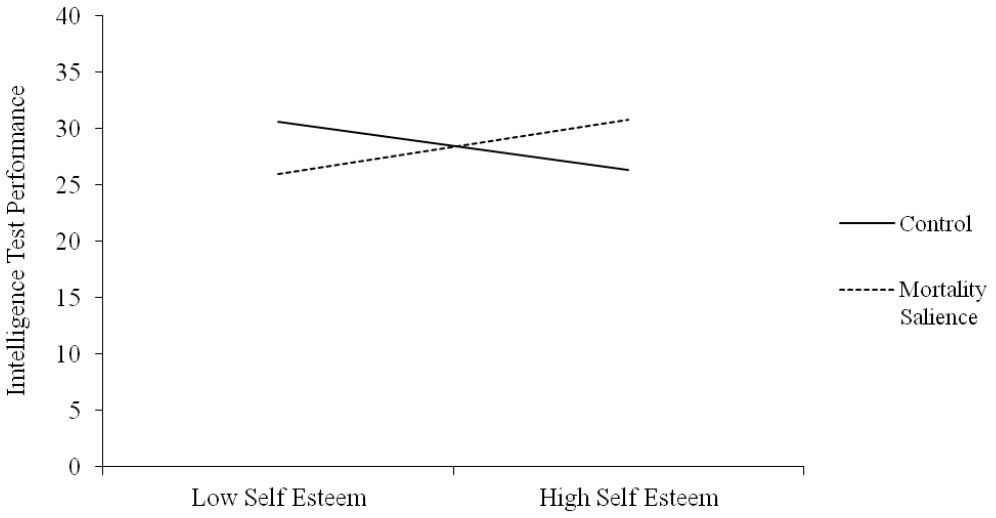

Figure 4. Intelligence test performance as a function of mortality salience and self esteem. Means are depicted for low (-1 SD) and high (1 SD) self esteem. Scale ranges from 0 to 35, with higher numbers signifying better scores on the GMAT.

We found the opposite pattern in the control condition; here, participants low in self esteem tended to score higher on the intelligence test than people high in self esteem; again, this was not statistically significant, β = -.35, p = .11. We also found that for people low in self esteem who were in the control condition scored higher on the intelligence test than people who were in the mortality salience condition, however, this was not significant β = -.32, p = .16. Finally, when high in self esteem participants who were in the mortality salience condition scored higher on the intelligence test than people in the control condition, β = 3.73, p = .11.

We also found a marginally significant interaction between mortality salience condition and self esteem on working memory performance, β = .38, $p < .10$, $\Delta R^2 = .07$ (see Table 5 and Figure 5). Post hoc analyses revealed that in the mortality salience condition there was no difference between people who had high self esteem or low self esteem on working memory capacity scores, β = .30, p = .20.

Table 5

Hierarchical regressions of working memory capacity from mortality salience condition, self esteem, and their interaction.

Term	*B*	*SE B*	β
Step 1			
Mortality salience condition [a]	2.12	4.52	.08
Self esteem	.27	2.23	.02
Step 2			
Mortality salience condition [a]	2.62	4.44	..1
Self esteem	-3.53	3.12	.-.26
Self esteem x mortality salience condition [a]	7.57	4.41	.38

Notes. $R^2 > .01$ ($p > .05$) in Step 1, $\Delta R^2 = .08$ in Step 2 ($p < .10$). All βs are non-significant (ps > .05), unless indicated otherwise.

[a] Dummy coded with mortality salience = 1, dental pain

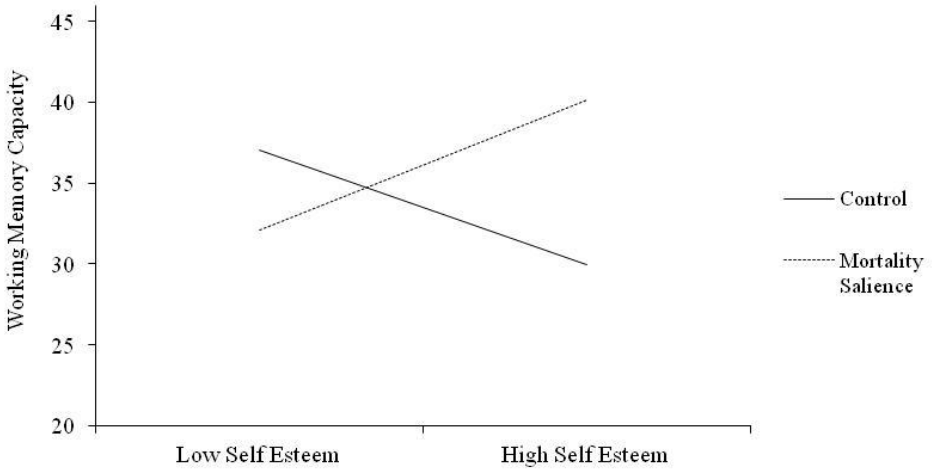

Figure 5. Working memory capacity as a function of mortality salience and self esteem. Means are depicted for low (-1 SD) and high (1 SD) self esteem. Scale ranges from 20 to 45, with higher numbers signifying better scores on the working memory task.

Similarly there was no significant difference in intelligence test performance between people high and low in self-esteem in the control condition, $\beta = -.26$, $p = .27$. We also found no difference in working memory capacity scores between conditions for people low self esteem, $\beta = -.18$, $p = .42$. When high in self-esteem, participants in the mortality salience condition tended to score higher on the working memory task than people in the control condition; however this was not significant, $\beta = .37$, $p = .12$. We found no other significant interactions of mortality salience condition with the other moderators we investigated, specifically fear of death and dying, religious fundamentalism, and mindfulness, in predicting working memory capacity or intelligence test performance (ps > .23).

Discussion

In Study 2, we were unable to replicate threat effects on either intelligence test performance or working memory capacity. However, we found that self esteem moderated mortality salience effects. We found our results of self esteem to be consistent with previously shown literature

such acting as an anxiety buffer against one's eventual and inevitable end to life (Pyszczynski, Greenberg, Solomon, Arndt, & Schimel, 2004; Schmeichel et al., 2009). This means in both intelligence test performance and working memory capacity individuals who were high in self esteem were able to buffer against and remain unaffected by the mortality salience threat. The failure to replicate main effects of mortality salience on intellectual performance from Study 1 could be due to this effect as well as the effect of mortality salience on working memory capacity.

General Discussion

Our main intention for these studies was to replicate previous self threat effects on intelligence test performance. In Study 1, we were able to replicate threat effects on intelligence test performance but not working memory capacity. Neither of our original hypotheses were supported in Study 2; however, self-esteem moderated the effects of mortality salience on intelligence test performance and working memory capacity.

Several factors might influence why we were unable to replicate main effects of Study 1 in Study 2. Perhaps the most profound reason was that self-esteem moderated mortality salience effects: There was a trend that people who possessed high self esteem remained unaffected by the mortality salience manipulation in both intelligence test scores and working memory scores. As previously stated, self esteem has been shown to be an anxiety buffer against threats to people's very existence (Pyszczynski, et al., 2004). We were able to replicate this finding from the Terror Management Theory literature (Burke, et al., 2010).

Though this line of research was geared toward producing evidence that reduced working memory capacity is the process underlying intellectual impairments after existential threat, it is possible that working memory capacity is not the mechanism for our effects of mortality salience

on decreased intelligence test performance. This would suggest that our preliminary idea – that working memory capacity is the main mechanism underlying the effects of self-threats in general – is limited and needs to be modified. In this case, other mechanisms such as motivation (Fritsche, Jonas, Fankh, & nel, 2008) should be investigated as potential mechanisms.

Another reason why we did not replicate effects of the first study in Study 2 could be attributed to the length of the delay between the manipulation and the dependent variables. In the dual-process theory of proximal and distal defenses (Jeff Greenberg, Pyszczynski, Solomon, Simon, & Breus, 1994; Jeff Greenberg, Solomon, & Pyszczynski, 1997; Pyszczynski, et al., 1999) states that people use proximal defenses right after a mortality salience manipulation. When using proximal defenses threat effects disappear; however when there is a time delay following mortality salience distal defenses are activated. Distal defenses allow for an increase in accessibility of death-related thought, but not conscious thought of death. In Study 1, after the manipulation participants completed a word search puzzle for one minute followed by two dependent variables - the Trail Making Test (Corrigan & Hinkeldey, 1987) and then the GMAT (Janda, 1996). The word search and the Trail Making Task account for about (≈6-8 minutes) until participants started on the intelligence test. The 6-8 minutes in between the manipulation and the intelligence test might have allowed for the death threat to move into a distal defense position, explaining why their working memory scores were unaffected but their intelligence test scores were reduced. In other words, the Trail Making Test could have been acting as a second filler task, allowing participants to engage in distal defense when taking the intelligence test. In the distal defense, people are trying to bolster the anxiety of one's own death and this might be cognitively draining and also mentally distracting. This might explain why their scores were reduced. However, further research would be necessary to see if one or two filler tasks make a

difference in intelligence test performance. Contrary to Study 1, Study 2 had a much longer working memory task (≈12-15 minutes total). Perhaps due to this longer delay between the manipulation and the dependent variable the accessibility of death-related thought (distal defenses) might have been surpassed, providing an explanation for why there was no significant change in intelligence test scores.

Potential limitations of both studies include the strength of the mortality salience manipulation. Further directions could increase the strength of mortality salience by hosting experiments in cubicles instead of groups ranging from one to four. Putting participants in separate rooms might eliminate possible distractions of other people. Additionally, the air conditioning in the room we used was abnormally loud which could have been a distraction. Adding another death prime such as a picture of a tombstone, reading a letter about visiting a morgue, or even holding the experiment at a place nearby a cemetery might be effective in inducing a more intense mortality salience prime. Another potential limitation was our sample. We relied on College students, who are relatively young population and thus may not be affected by mortality salience as much as older people; for older people thoughts about their own death may be more frightening than for younger people. Thus, using older samples could increase effects of mortality salience on intelligence test performance.

Further replication is needed to see if mortality salience does significantly decrease intelligence test performance. Our marginal results of reduced intelligence test performance in Study 1 indicate that this is the case. Death is important to all people, because we all have to face it ultimately. As another future directions of particular importance to me would be to replicate Study 1 in a high school located in a high violence neighborhood or city. Students in these areas might experience mortality salience every day when walking to class or coming home

from class. If we can understand how mortality salience affects cognitive performance, we might be able to implement programs about how to combat mortality effects in schools that have kids who might be confronted with mortality salience every day. Also, understanding mortality salience's effects on cognitive importance might be of high value to help military personnel who often have to make complex cognitive decisions while in the face of their own death during combat. Clarifying mortality salience effects on cognitive performance is the first step for combating these effects. Interventions of self-esteem would be the first step to give insight into these cognitively impairing effects.

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Appendix

Appendix 1: Rosenberg Self-esteem Scale (modified from Rosenberg, 1965)

Please read each item below and then indicate how well each statement describes you using the following response scale:

1	2	3	4	5
extremely uncharacteristic				extremely characteristic

_____ 1. On the whole, I am satisfied with myself.

_____ 2. At times I think I am no good at all. **REV**

_____ 3. I feel that I have a number of good qualities.

_____ 4. I am unable to do things as well as most other people. **REV**

_____ 5. I feel I do not have much to be proud of. **REV**

_____ 6. I certainly feel useless at times. **REV**

_____ 7. I feel that I am a person of worth, at least on an equal plane with others.

_____ 8. I wish I could have more respect for myself. **REV**

_____ 9. All in all, I am inclined to feel that I am a failure. **REV**

_____ 10. I take a positive attitude toward myself.

Appendix 2: Fear of Death and Dying (Collett & Lester, 1969):

REVISED COLLETT-LESTER FEAR OF DEATH AND DYING SCALE
How disturbed or made anxious are you by the following aspects of death and dying? Read each item and answer it quickly. Don't spend too much time thinking about your response. We want your first impression of how you think right now. Circle the number that best represents your feeling.

Your Own Death very somewhat not
1. The total isolation of death 5 4 3 2 1
2. The shortness of life 5 4 3 2 1
3. Missing out on so much after you die 5 4 3 2 1
4. Dying young 5 4 3 2 1
5. How it will feel to be dead 5 4 3 2 1
6. Never thinking or experiencing 5 4 3 2 1
7. The possibility of pain and punishment during life-after-death 5 4 3 2 1
8. The disintegration of your body after you die 5 4 3 2 1

Your Own Dying very somewhat not
1. The physical degeneration involved 5 4 3 2 1
2. The pain involved in dying 5 4 3 2 1
3. The intellectual degeneration of old age 5 4 3 2 1
4. That your abilities will be limited as you lie dying 5 4 3 2 1
5. The uncertainty as to how bravely you will face the process of dying 5 4 3 2 1
6. Your lack of control over the process of dying 5 4 3 2 1
7. The possibility of dying in a hospital away from friends and family 5 4 3 2 1
8. The grief of others as you lie dying 5 4 3 2 1

The Death of Others very somewhat not
1. The loss of someone close to you 5 4 3 2 1
2. Having to see their dead body 5 4 3 2 1
3. Never being able to communicate with them again 5 4 3 2 1
4. Regret over not being nicer to then when they were alive 5 4 3 2 1
5. Growing old alone without them 5 4 3 2 1
6. Feeling guilty that you are relieved that they are dead 5 4 3 2 1
7. Feeling lonely without them 5 4 3 2 1
8. Envious that they are dead 5 4 3 2 1

The Dying of Others very somewhat not
1. Having to be with someone who is dying 5 4 3 2 1
2. Having them want to talk about death to you 5 4 3 2 1
3. Watching then suffer from pain 5 4 3 2 1
4. Having to be the one to tell them they are dying 5 4 3 2 1
5. Seeing the physical degeneration of their body 5 4 3 2 1
6. Not knowing what to do about their grief at losing them when you are with them 5 4 3 2 1
7. Watching the deterioration of their mental abilities 5 4 3 2 1
8. Being reminded that you are going to go through the experience also one day 5 4 3 2 1

Appendix 3: Religious Fundamentalism (Altemeyer & Hunsberger, 1992):

You will probably find that you agree with some of the following statements, and disagree with others, to varying extents. Please indicate your reaction to each statement according to the following scale:

-4 = You **very strongly disagree** with the statement.
-3 = You **strongly disagree** with the statement.
-2 = You **moderately disagree** with the statement.
-1 = You **slightly disagree** with the statement.
0 = You **feel exactly and precisely neutral** about the statement.
1 = You **slightly agree** with the statement.
2 = You **moderately agree** with the statement.
3 = You **strongly agree** with the statement.
4 = You **very strongly agree** with the statement.

Important: You may find that you sometimes have different reactions to different parts of a statement. For example, you might very strongly disagree ("-4") with one idea in a statement, but slightly agree ("+1") with another idea in the same item. When this happens, please combine your reactions, and [record] how you feel on balance (a "-3" in this case).

1. God has given humanity a complete, unfailing guide to happiness and salvation, which must be totally followed
   -4 -3 -2 -1 0 1 2 3 4
2. No single book of religious teachings contains all the intrinsic, fundamental truths about life
   -4 -3 -2 -1 0 1 2 3 4 R
3. The basic cause of evil in this world is Satan, who is still constantly and ferociously fighting against God
   -4 -3 -2 -1 0 1 2 3 4
4. It is more important to be a good person than to believe in God and the right religion
   -4 -3 -2 -1 0 1 2 3 4 R
5. There is a particular set of religious teachings in this world that are so true, you can't go any "deeper" because they are the basic, bedrock message that God has given humanity
   -4 -3 -2 -1 0 1 2 3 4
6. when you get right down to it, there are basically only two kinds of people in the world: the Righteous, who will be rewarded by God, and the rest, who will not
   -4 -3 -2 -1 0 1 2 3 4
7. Scriptures may contain general truths, but they should **not** be considered completely, literally true from beginning to end R
   -4 -3 -2 -1 0 1 2 3 4

8. To lead the best, most meaningful life, one must belong to the one, fundamentally true religion
   -4 -3 -2 -1 0 1 2 3 4
9. "Satan" is just the name people give to their own bad impulses. There really is *no such thing* as a diabolical "Prince of Darkness" who tempts us
   -4 -3 -2 -1 0 1 2 3 4 R
10. Whenever science and sacred scripture conflict, *science* is probably right
    -4 -3 -2 -1 0 1 2 3 4 R
11. The fundamentals of God's religion should never be tampered with, or compromised with others' beliefs
    -4 -3 -2 -1 0 1 2 3 4
12. *All* of the religions in the world have flaws and wrong teachings. There is *no* perfectly true, right religion
    -4 -3 -2 -1 0 1 2 3 4 R

Appendix 4: **Rejection Sensitivity Questionnaire (Downey & Feldman, 1996)**

Each of the items below describes things college students sometimes ask of other people. Please imagine that you are in each situation. You will be asked to answer the following questions:

1) How <u>concerned or anxious</u> would you be about how the other person would respond?

2) How do you think <u>the other person</u> would be <u>likely to respond</u>?

1. You ask someone in class if you can borrow his/her notes.

How concerned or anxious would you be over whether	very unconcerned					very concerned
or not the person would want to lend you his/her notes?	1	2	3	4	5	6
I would expect that the person would willingly give me	very unlikely					very likely
his/her notes.	1	2	3	4	5	6

2. You ask your boyfriend/girlfriend to move in with you.

How concerned or anxious would you be over whether or not the person would want to move in with you?	very unconcerned 1 2 3 4 5 6	very concerned
I would expect that he/she would want to move in with me.	very unlikely 1 2 3 4 5 6	very likely

3. You ask your parents for help in deciding what programs to apply to.

How concerned or anxious would you be over whether or not your parents would want to help you?	very unconcerned 1 2 3 4 5 6	very concerned
I would expect that they would want to help me.	very unlikely 1 2 3 4 5 6	very likely

4. You ask someone you don't know well out on a date.

How concerned or anxious would you be over whether or not the person would want to go out with you?	very unconcerned 1 2 3 4 5 6	very concerned
I would expect that the person would want to go out with me.	very unlikely 1 2 3 4 5 6	very likely

5. Your boyfriend/girlfriend has plans to go out with friends tonight, but you really want to spend the evening with him/her, and you tell him/her so.

How concerned or anxious would you be over whether or not your boyfriend/girlfriend would decide to stay in?	very unconcerned	1	2	3	4	5	6 very concerned
I would expect that the person would willingly choose to stay in.	very unlikely	1	2	3	4	5	6 very likely

6. You ask your parents for extra money to cover living expenses.

How concerned or anxious would you be over whether or not your parents would help you out?	very unconcerned	1	2	3	4	5	6 very concerned
I would expect that my parents would not mind helping me out.	very unlikely	1	2	3	4	5	6 very likely

7. After class, you tell your professor that you have been having some trouble with a section of the course and ask if he/she can give you some extra help.

How concerned or anxious would you be over whether or not your professor would want to help you out?	very unconcerned	1	2	3	4	5	6 very concerned
I would expect that my professor would want to help me out.	very unlikely	1	2	3	4	5	6 very likely

8. You approach a close friend to talk after doing or saying something that seriously upset him/her.

How concerned or anxious would you be over whether or not your friend would want to talk with you?	very unconcerned 1	2	3	4	5	very concerned 6
I would expect that he/she would want to talk with me to try to work things out.	very unlikely 1	2	3	4	5	very likely 6

9. You ask someone in one of your classes to coffee.

How concerned or anxious would you be over whether or not the person would want to go?	very unconcerned 1	2	3	4	5	very concerned 6
I would expect that the person would want to go with me.	very unlikely 1	2	3	4	5	very likely 6

10. After graduation, you can't find a job and ask your parents if you can live at home for a while.

How concerned or anxious would you be over whether or not your parents would want you to come home?	very unconcerned 1	2	3	4	5	very concerned 6
I would expect I would be welcome at home.	very unlikely 1	2	3	4	5	very likely 6

11. You ask your friend to go on a vacation with you over Spring Break.

How concerned or anxious would you be over whether or not your friend would want to go with you? very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to go with me. very unlikely 1 2 3 4 5 6 very likely

12. You call your boyfriend/girlfriend after a bitter argument and tell him/her you want to see him/her.

How concerned or anxious would you be over whether or not your boyfriend/girlfriend would want to see you? very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would want to see me. very unlikely 1 2 3 4 5 6 very likely

13. You ask a friend if you can borrow something of his/hers.

How concerned or anxious would you be over whether or not your friend would want to loan it to you? very unconcerned 1 2 3 4 5 6 very concerned

I would expect that he/she would willingly loan me it. very unlikely 1 2 3 4 5 6 very likely

14. You ask your parents to come to an occasion important to you.

How concerned or anxious would you be over whether or not your parents would want to come? very unconcerned 1 2 3 4 5 6 very concerned

I would expect that my parents would want to come. very unlikely very likely

1 2 3 4 5 6

15. You ask a friend to do you a big favor.

How concerned or anxious would you be over whether very unconcerned very concerned

or not your friend would do this favor? 1 2 3 4 5 6

I would expect that he/she would willingly do very unlikely very likely

this favor for me. 1 2 3 4 5 6

16. You ask your boyfriend/girlfriend if he/she really loves you.

How concerned or anxious would you be over whether very unconcerned very concerned

or not your boyfriend/girlfriend would say yes? 1 2 3 4 5 6

I would expect that he/she would answer yes sincerely. very unlikely very likely

1 2 3 4 5 6

17. You go to a party and notice someone on the other side of the room and then you ask them to dance.

How concerned or anxious would you be over whether very unconcerned very concerned

or not the person would want to dance with you? 1 2 3 4 5 6

I would expect that he/she would want to dance with me.	very unlikely						very likely
	1	2	3	4	5	6	

18. You ask your boyfriend/girlfriend to come home to meet your parents.

How concerned or anxious would you be over whether or not your boyfriend/girlfriend would want to meet your parents?	very unconcerned						very concerned
	1	2	3	4	5	6	
I would expect that he/she would want to meet my parents.	very unlikely						very likely
	1	2	3	4	5		

Appendix 5: Right Wing Authoritarianism (RWA; Altemeyer and Hunsberger 1992):

Each item can be scored on a 7 point scale. For questions 1-4 and 6, score each strongly agree as 7 points, each agree as 6, slightly agree as 5, unsure as 4, and so on down to 1 point for strongly disagree.

For question 5, reverse the listing as 1 point for strongly agree, and counting up to 7 for strongly disagree.

Q1 **Our country desperately needs a mighty leader who will do what has to be done to destroy the radical new ways and sinfulness that are ruining us:**
7=strongly agree, 6=agree 5=somewhat agree,4=unsure 3=somewhat disagree, 2=disagree 1=strongly disagree

Q2 **The only way our country can get through the crisis ahead is to get back to our traditional values, put some tough leaders in power, and silence the troublemakers spreading bad ideas**.
7=strongly agree, 6=agree 5=somewhat agree,4=unsure 3=somewhat disagree, 2=disagree 1=strongly disagree

Q3 **Our country will be destroyed someday if we do not end the perversions eating away at our moral fiber and moral beliefs.**
7=strongly agree, 6=agree 5=somewhat agree,4=unsure 3=somewhat disagree, 2=disagree

1=strongly disagree

Q4 **What our country needs is more discipline, with everyone following our leaders in unity.**
7=strongly agree, 6=agree 5=somewhat agree,4=unsure 3=somewhat disagree, 2=disagree
1=strongly disagree

Q5 **There is no "One Right Way" to live life; everybody has to create their own way**.
1=strongly agree, 2=agree 3=somewhat agree,4=unsure 5=somewhat disagree, 6=disagree
7=strongly disagree

Q6 **God's laws about abortion, pornography, and marriage must be strictly followed before it is too late, and those who break them must be strongly punished.**
7=strongly agree, 6=agree 5=somewhat agree,4=unsure 3=somewhat disagree, 2=disagree
1=strongly disagree

Appendix 6: Fear of Negative Evaluations (Leary, 1983):

Read each of the following statements carefully and indicate how characteristic it is of you according to the following scale" 1=Not at all characteristic of me, 2=Slightly characteristic of me, 3=Moderately characteristic of me, 4=Very characteristic of me, 5=Extremely characteristic of me

1. I worry about what people will think of me even when I know it doesn't make any difference.

2. I am unconcerned even if I know people are forming an unfavorable impression of me. R

3. I am frequently afraid of other people noticing my shortcomings.

4. I rarely worry about what kind of impression I am making on someone. R

5. I am afraid that others will not approve of me.

6. I am afraid that people will find fault with me.

7. Other people's opinions of me do not bother me. R

8. When I am talking to someone, I worry about what they may be thinking about me.

9. I am usually worried about what kind of impression I make.

10. If I know someone is judging me, it has little effect on me. R

11. Sometimes I think I am too concerned with what other people think of me.

12. I often worry that I will say or do the wrong things.

R indicates Reverse Score

Appendix 7: Mortality Salience Manipulation: On the following page are two open-ended questions, please respond to them with your first, natural response.

We are looking for peoples' gut-level reactions to these questions.

The Projective Life Attitudes Assessment

This assessment is a recently developed, innovative personality assessment. Recent research suggests that feelings and attitudes about significant aspects of life tell us a considerable amount about the individual's personality. Your responses to this survey will be content-analyzed in order to assess certain dimensions of your personality. Your honest responses to the following questions will be appreciated.

1. PLEASE BRIEFLY DESCRIBE THE EMOTIONS THAT THE THOUGHT OF YOUR OWN DEATH AROUSES IN YOU.

_____

_____

_____

_____

_____

_____

_____

2. JOT DOWN, AS SPECIFICALLY AS YOU CAN, WHAT YOU THINK WILL HAPPEN TO YOU AS YOU PHYSICALLY DIE AND ONCE YOU ARE PHYSICALLY DEAD.

_____

_____

_____

_____

_____

_____

_____

Appendix 8: Mortality Salience Control Manipulation 1: (tmt.missouri.edu)

On the following page are two open-ended questions, please respond to them with your first, natural response.

We are looking for peoples' gut-level reactions to these questions.

The Projective Life Attitudes Assessment

This assessment is a recently developed, innovative personality assessment. Recent research suggests that feelings and attitudes about significant aspects of life tell us a considerable amount about the individual's personality. Your responses to this survey will be content-analyzed in order to assess certain dimensions of your personality. Your honest responses to the following questions will be appreciated.

1. PLEASE BRIEFLY DESCRIBE THE EMOTIONS THAT THE THOUGHT OF VISITING THE DENTIST AROUSES IN YOU.

_____

_____

_____

_____

_____

_____

_____

2. JOT DOWN, AS SPECIFICALLY AS YOU CAN, WHAT YOU THINK WILL HAPPEN TO YOU PHYSICALLY WHEN YOU VISIT THE DENTIST.

_____

_____

_____

_____

_____

_____

_____

Appendix 9: General Mental abilities Test (GMAT; Janda, 1996)

Problem Solving Task

Directions: The following problem solving task contains five sections, all of which consist of multiple-choice questions. You have 6 minutes to complete as many questions as you can. Indicate your answer, even if you are not sure whether your solution is correct.

ANALOGIES
Directions: For the following items, select the alternative that best completes the sentence.

1. Scant is to deficient as sedate is to ___.
    a) serene
    b) moody
    c) frivolous

d) flippant

2. Renounce is to accept as imperfect is to ___.
   a) defective
   b) deficient
   c) flawless
   d) scanty

3. Lack is to surplus as renounce is to ___.
   a) abjure
   b) accept
   c) repudiate
   d) abdicate

4. Ascertain is to learn as petty is to ___.
   a) trivial
   b) magnanimous
   c) significant
   d) substantial

5. Essential is to fundamental as endorse is to ___.
   a) sanction
   b) condemn
   c) denounce
   d) reprove

6. Exile is to ostracize as ethical is to ___.
   a) immoral
   b) honorable
   c) promiscuous
   d) lecherous

7. Oppression is to justice as obtain is to ___.
   a) forgo
   b) purchase
   c) procure
   d) acquire

8. Sheer is to opaque as parallel is to ___.
   a) analogous
   b) coinciding
   c) divergent
   d) similar

9. Remit is to retain as nasty is to ___.
   a) repellent
   b) odious
   c) beastly
   d) delightful

10. Bat is to human as whale is to ___.
    a) frog
    b) bear
    c) bird
    d) carp

11. Efface is to obliterate as general is to ___.
    a) inexact
    b) exact
    c) extinct
    d) specific

12. Large is to minute as pacific is to ___.
    a) bellicose
    b) halcyon
    c) tranquil
    d) placid

VOCABULARY
Directions: Each word in capital letters is followed by four words. Pick the word that comes closest in meaning to the word in capitals.

13. CABINET
    a) bureau
    b) federal
    c) open
    d) drawer

14. OBSTACLE
    a) impediment
    b) gate
    c) yard
    d) gateway

15. CONTENT
    a) shape
    b) hinder
    c) satisfied
    d) appalled

16. ABDICATE
    a) appease
    b) suggest
    c) dictate
    d) resign

17. LOQUACIOUS

a) parsimonious
b) courageous
c) verbose
d) cautious

18. LITURGY
a) livid
b) angry
c) ritual
d) spoiled

19. PASTORAL
a) religious
b) graze
c) neglect
d) peaceful

20. MOPE
a) stupid
b) relax
c) clean
d) apathetic

21. LACONIC
a) concise
b) intelligent
c) colorful
d) quiet

22. SERPENTINE
a) treacherous
b) frightening
c) misleading
d) silly

23. MISCREANT
a) villain
b) incorrect
c) ineptitude
d) fortuitous

24. OSTENTATIOUS
a) generous
b) brilliance
c) pecuniary
d) pretentious

GENERAL INFORMATION
Directions: For each of the following items, select the correct answer.

25. What is the first month of the year that has exactly 30 days?
    a) January
    b) February
    c) March
    d) April

26. What planet has the shortest year?
    a) Earth
    b) Pluto
    c) Mercury
    d) Uranus

27. What is the world's northernmost national capital?
    a) Stockholm
    b) London
    c) Reykjavik
    d) Oslo

28. To the nearest day, how long does it take the moon to revolve around the Earth?
    a) 1 day
    b) 27 days
    c) 30 days
    d) 365 days

29. What is the Fahrenheit equivalent of 0 degrees Celsius?
    a) -32 degrees
    b) 0 degrees
    c) 32 degrees
    d) 212 degrees

30. How many dimensions does a solid have?
    a) one
    b) two
    c) three
    d) four

31. Who wrote *Gone With the Wind?*
    a) Sylvia Plath
    b) Scarlett O'Hara
    c) Gertrude Stein
    d) Margaret Mitchell

32. In what month is Groundhog Day?
    a) January
    b) February
    c) March
    d) May

33. What is “The Windy City”?
    a) New York
    b) Detroit
    c) Chicago
    d) San Francisco

34. How many miles are there in a kilometer?
    a) .4
    b) .6
    c) 1
    d) 1.6

35. Who holds the record for career home runs?
    a) Babe Ruth
    b) Lou Gehrig
    c) Mickey Mantle
    d) Barry Bonds

36. What two cities were the subject of Dicken’s *A Tale of Two Cities*
    a) London and Madrid
    b) London and Paris
    c) London and Berlin
    d) London and New York

MATHEMATICAL PROBLEMS
Directions: For each of the following items, select the correct answer. You may use scratch paper.

37. If $2x + y = 5$, then $6x + 3y = ?$
    a) 2/5
    b) 3/9
    c) 15
    d) 18

38. One side of a rectangle is 3 feet long and the diagonal is 5 feet long. What is its area?
    a) 6
    b) 7.5
    c) 12
    d) 15

39. Rosanne’s trail mix uses 6 ounces of M&Ms for every 9 ounces of Hershey’s Kisses. How many ounces of M&Ms are needed for 75 ounces of trail mix?
    a) 25
    b) 30
    c) 32.5
    d) 36

40. The diagonal of a rectangle is 5 feet, and one side is 4 feet long. What is the perimeter?
    a) 12 feet
    b) 14 feet
    c) 16 feet
    d) 18 feet

41. A club of 60 people has 36 men. What percentage of the club is women?
    a) 20 percent
    b) 24 percent
    c) 40 percent
    d) 40 percent

42. The average of 3 single-digit numbers is 7. The smallest that one of the numbers can be is:
    a) 0
    b) 1
    c) 2
    d) 3

43. The hypotenuse of a right triangle is 5 feet long, and its area is 6 square feet. One of the sides of the triangle is:
    a) 1.2 feet
    b) 2 feet
    c) 2.5 feet
    d) 4 feet

44. ¼ x ¾ / 4/5 =?
    a) 7/13
    b) 15/64
    c) 15/4
    d) 12/20

46. Which of the following is the largest number?
    a) 13/64
    b) 21/40
    c) 26/70
    d) 51/100

47. Sally is 2 years older than her brother. Twelve years ago, she was twice as old as he was. How old is Sally now?
    a) 14
    b) 16
    c) 20
    d) 32

48. There were 16 teams in a basketball tournament. When a team lost, it was eliminated from the tournament. How many games had to be played to determine a champion?
    a) 4
    b) 9
    c) 15

d) 31

SPATIAL PROBLEMS

Directions: For the following items, your task is to select the picture on the right that would result if the pieces on the left side of the page were put together properly. There is only one correct answer for each item.

49.

a.

b.

c.

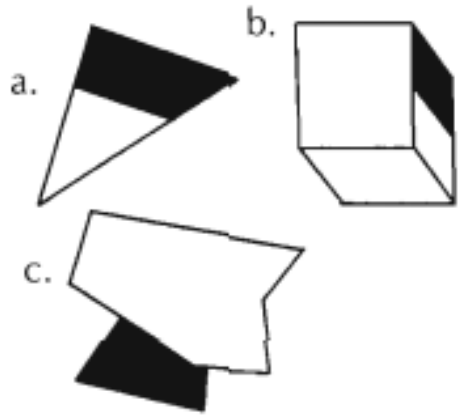
50.

a.

b.

c.

51.



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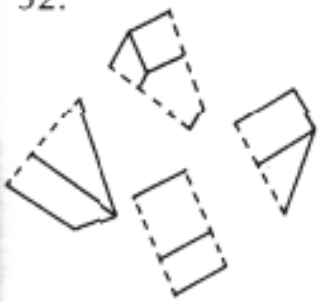

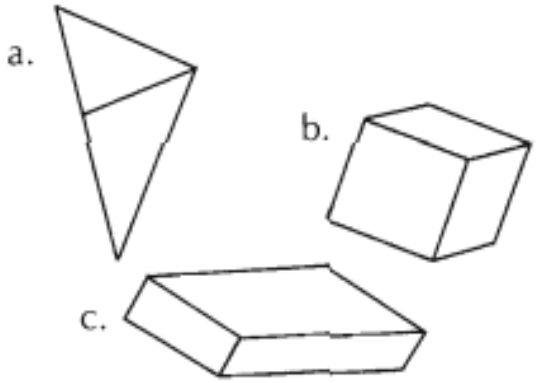

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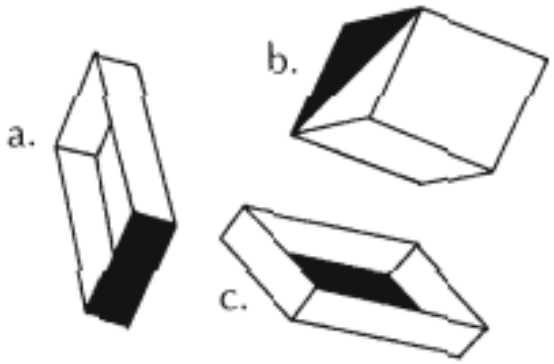
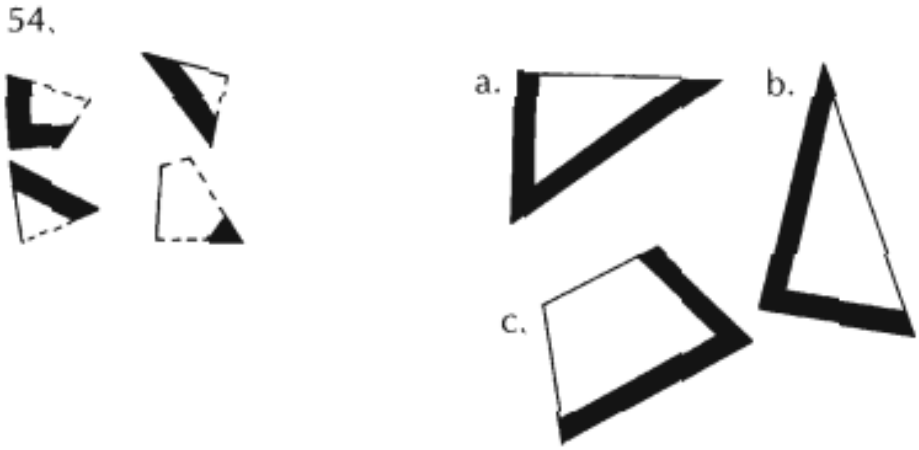




Appendix 10: Working Memory Task

Trail Making Test (TMT) Parts A & B

Instructions:

Both parts of the Trail Making Test consist of 25 circles distributed over a sheet of paper. In Part A, the circles are numbered 1 – 25, and the patient should draw lines to connect the numbers in ascending order. In Part B, the circles include both numbers (1 – 13) and letters (A – L); as in Part A, the patient draws lines to connect the circles in an ascending pattern, but with the added task of alternating between the numbers and letters (i.e., 1-A-2-B-3-C, etc.). The patient should be instructed to connect the circles as quickly as possible, without lifting the pen or pencil from the paper. Time the patient as he or she connects the "trail." If the patient makes an error, point it out immediately and allow the patient to correct it. Errors affect the patient's score only in that the correction of errors is included in the completion time for the task. It is unnecessary to continue the test if the patient has not completed both parts after five minutes have elapsed.

Step 1: Give the patient a copy of the Trail Making Test Part A worksheet and a pen or pencil.
Step 2: Demonstrate the test to the patient using the sample sheet (Trail Making Part A – *SAMPLE*).
Step 3: Time the patient as he or she follows the “trail” made by the numbers on the test.
Step 4: Record the time.
Step 5: Repeat the procedure for Trail Making Test Part B.

Scoring:

Results for both TMT A and B are reported as the number of seconds required to complete the task; therefore, higher scores reveal greater impairment.

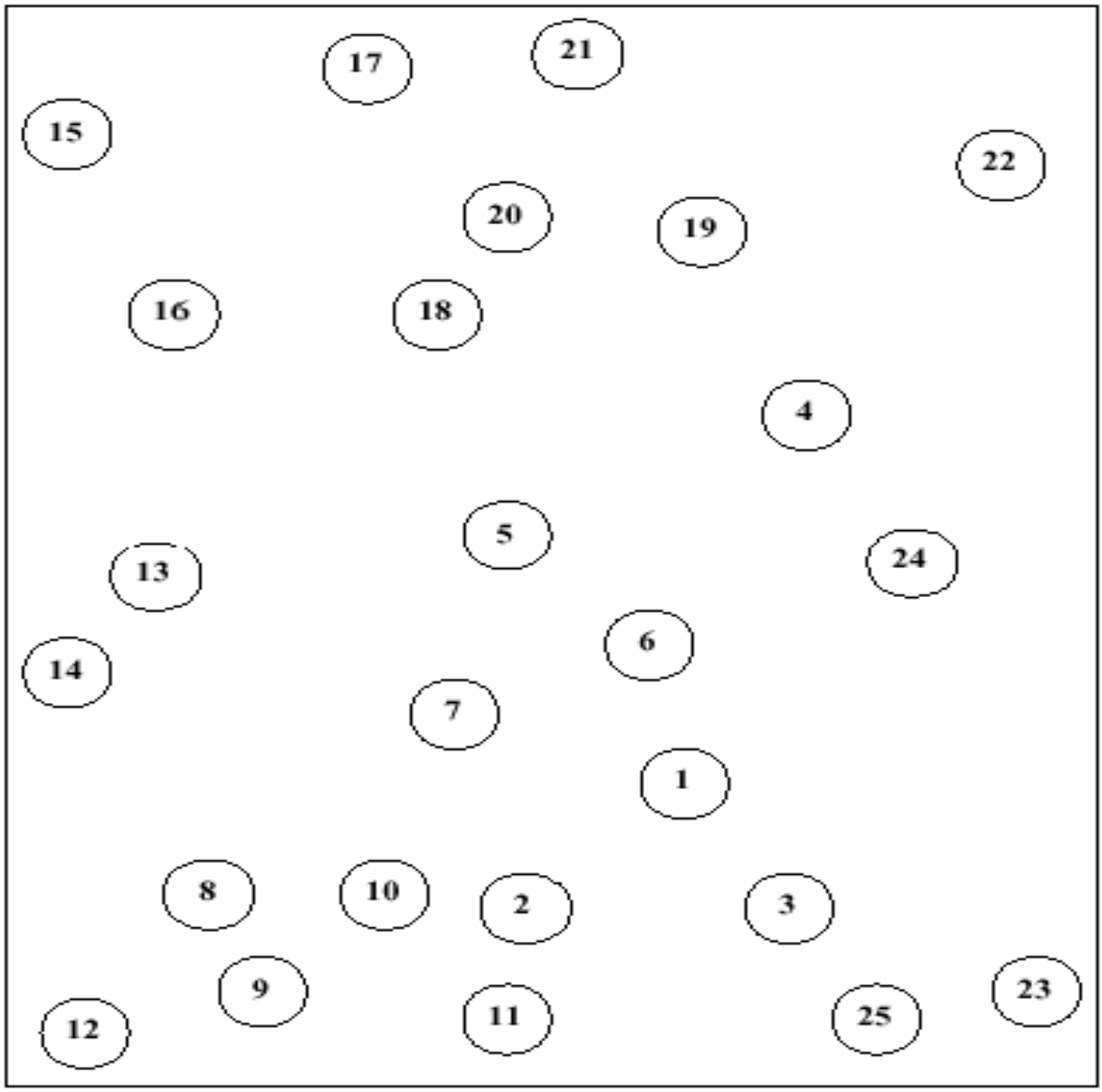
Average Deficient Rule of Thumb

Trail A 29 seconds > 78 seconds Most in 90 seconds
Trail B 75 seconds > 273 seconds Most in 3 minutes

Sources:

• Corrigan JD, Hinkeldey MS. Relationships between parts A and B of the Trail Making Test. *J*

Clin Psychol. 1987;43(4):402–409.
• Gaudino EA, Geisler MW, Squires NK. Construct validity in the Trail Making Test: what makes Part B harder? *J Clin Exp Neuropsychol*. 1995;17(4):529-535.
• Lezak MD, Howieson DB, Loring DW. *Neuropsychological Assessment*. 4th ed. New York: Oxford University Press; 2004.
• Reitan RM. Validity of the Trail Making test as an indicator of organic brain damage. *Percept Mot Skills*. 1958;8:271-276.



Part B: Trial Making Test